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ABSTRACT

Developed by educators from the Emily Griffith Opportunity School, this teacher's guide was developed for a 4-hour workshop to teach employees how to read the charts and graphs they need in the workplace. The unit covers four types of graphs: pictographs, bar graphs, line graphs, and circle graphs. The guide is divided into four sections: reading charts, reading graphs, reasons for using graphs and charts, and a vocabulary exercise. Sections include information and problems to solve, with content drawn from a hospital setting. An answer key is provided. Contains 3 references. (KC)

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ED 378 440

UNDERSTANDING GRAPHS & CHARTS

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UNDERSTANDING GRAPHS & CHARTS

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John J. Cleary
Mary Liles Gravely

July 8, 1994

INTRODUCTION TO THE WORKPLACE LITERACY PROJECT

This module was developed by educators from Emily Griffith Opportunity School as part of a National Workplace Education grant funded by the U.S. Department of Education. A cooperative effort between the business and education communities, the program was designed specifically to enhance employees' literacy skills.

Direct benefits to the workforce include improved morale and motivation, self-esteem, team work, and promotional opportunities.

We gratefully acknowledge the assistance of our partners. In addition we recognize all of the students who participated in classes and who provided us with invaluable feedback for strengthening future classes.

We hope partnerships such as these will provide the catalyst for developing new or continued on-site educational opportunities.

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FOREWORD

TO THE TEACHER

Employees need skills in reading charts. Those who work for an hourly wage must fill out pay sheets, and workers who change shifts must be able to read a work schedule. Also, employees need to be able to read workplace graphs. These graphs give them a visual presentation of information that allows them to draw conclusions or make comparisons about work-place situations.

PURPOSE

This unit is written for the student. It includes instructions and activities that will help students learn to read charts and graphs more effectively. The unit covers four types of graphs: the pictograph, the bar graph , the line graph, and the circle graph.

Before teaching this unit the instructor should discover why the students need this information. If the students read graphs and charts on the job, after reviewing the material in this module, the instructor should get copies of these graphs to teach in class. If the students need a knowledge of graphs to pass a standardized test, the instructor should use the material in this module, then follow that instruction with additional handouts that give practice in interpreting graphs. A number of good textbooks are available that contain exercises on reading graphs and charts. Some are listed at the end of this unit.

TIME

The instructor needs approximately four hours to cover the material in this unit.

AUDIENCE

The unit was written for any individual who needs to learn the basics of reading charts and graphs.

ANSWER KEY

The answer key for the charts and graphs is located on page 29.

SECTION 1 - READING CHARTS

Often you will be called upon to read and interpret charts. When you begin, look at the following:

1. the **TITLE** of the chart
2. any **HEADINGS** which might be there
3. the information in the **COLUMNS**
4. the **KEY** for any symbols which the chart may use

Title

Headings

Information in columns

Key for symbols

Time Schedule For Employees
1st Shift - May

Days of the month	3 W	4 T	5 F	8 M	9 T	10 W	11 T	12 F	15 M	16 T	17 W	18 T	19 F	
Name														
B. Able				D					D					
R. Brown	D					D					D			
C. Daniels		D			D			PL			D			
E. Miller			D					D					D	
D. Robinson		D					D					D		
G. Smith	D			V	V	V	V	V			D			

V - Vacation D - Day off PL - Personal Leave

Section 1

After you have identified the four parts of a chart, think about what each part tells you. What is the subject of the chart? How are the symbols used to give additional information?

Now answer the following questions using the information in the chart above.

1. What is the title of the chart? _____
   _____
2. How many people work on the first shift? _____
3. This is the work schedule for which month? _____
4. What person on the schedule will be off on Mondays? _____
   _____
5. Who will go on vacation in May? _____
6. Which person will be on personal leave? _____

Chart Reading Exercise

Nursing Personnel in Big City Hospital

	Number	Percent
Head Nurses	200	100
White	170	85
Black	18	9
Hispanic	6	3
Asian	4	2
Other	2	1
Staff Nurses	500	100
White	350	70
Black	75	15
Hispanic	35	7
Asian	25	5
Other	15	3

Use the table to answer the following questions.

1. What is the total number of head nurses? _____

2. What is the total number of Hispanic head nurses? _____

3. What percentage of the head nurses is Asian? _____

4. How many staff nurses are white? _____

5. What percent of staff nurses are black? _____

6. What is the total percent of Black, Hispanic, and Asian staff nurses? _____

7. How many more black staff nurses are there than black head nurses? _____

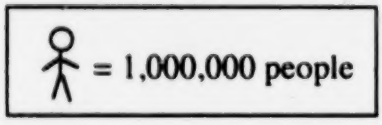
SECTION 2 - READING GRAPHS

In this section, you will study four types of graphs: the pictograph, the line graph, the bar graph, and the circle graph or as it is sometimes called, the pie chart.

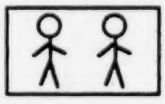
PICTOGRAPH

The pictograph uses pictures or symbols to represent numbers. The **KEY** to the pictograph will tell you how many things the picture represents.

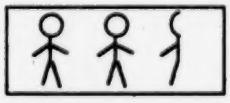
Example:



Imagine you are reading a graph showing the number of people with the flu each year. The **KEY** informs you that each figure represents 1 million people.



If you see two figures on a line in the graph, you will know that 2 million people had the flu during the year.



If the graph shows two complete figures and one half of another figure, these symbols mean two and one half million people had the flu that year.

IMPORTANT When reading a pictograph, pay close attention to the number of things each picture represents. You will find this information in the **KEY** or **LEGEND**.

As you learned when reading charts, you must look at specific parts of the graph.

1. The **TITLE** will tell you what the graph is about.
2. The **KEY** or **LEGEND** will tell you what the symbols mean.

Pictographs are useful when comparing general information.

EARNINGS IN NUTRITIONAL SERVICES
Average Hourly Earnings in Different Job Categories
at Big City Hospital
(Rounded to the nearest dollar)

Prep Cook	$ $ $ $ $
Chef	$ $ $ $ $ $
Tray passer	$ $ $ ½
Line Supervisor	$ $ $ $

KEY or LEGEND
$ = $2.00

Answer the following questions.

1. What is the title of the pictograph? _____
2. What department is represented in this graph? _____
3. What does each $ represent, according to the key? _____
4. Which group is paid the most? _____
5. Which group is paid the least? _____
6. What does a ½ stand for? _____

CIRCLE GRAPHS

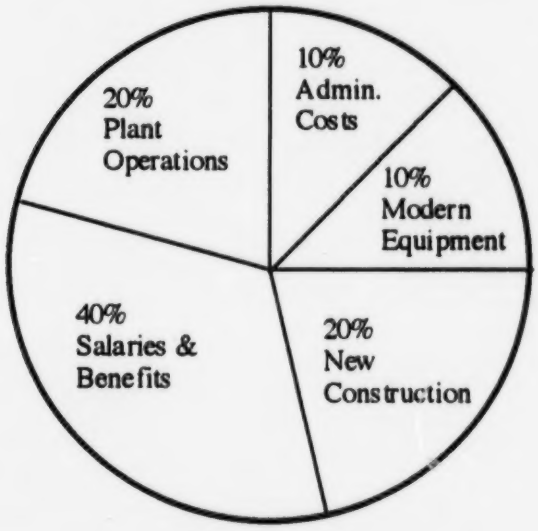
Circle graphs use a circle divided into parts. The circle represents the whole, and the pieces represent the parts. The circle graph can help people see how the whole breaks down into its various divisions. Very often the author of the graph includes the exact percentage along with the information he is showing.

1. The **TITLE** will tell you what the graph is about.

2. The **DIVISIONS** will allow the reader to compare parts and to see how much each part takes of the whole.

Budgets are often illustrated by the use of a circle graph.

Big City Hospital's 1992 Budget



Answer the following questions about the circle graph.

1. What percent of the 1992 budget is used for salaries and benefits? _____

2. What percent of the budget is used for new construction? _____

3. What is the total percent of all the categories when they are added up? _____

4. What percent of the budget is <u>not</u> used for Administrative Costs or Salaries and Benefits? _____

BAR GRAPHS

Bar graphs use bars to represent numbers. Data or information going up and down on the vertical axis or information going across the horizontal axis help you to understand what the graph is telling you. The bars in the graph can either be on the horizontal or vertical axes.

When reading the bar graph

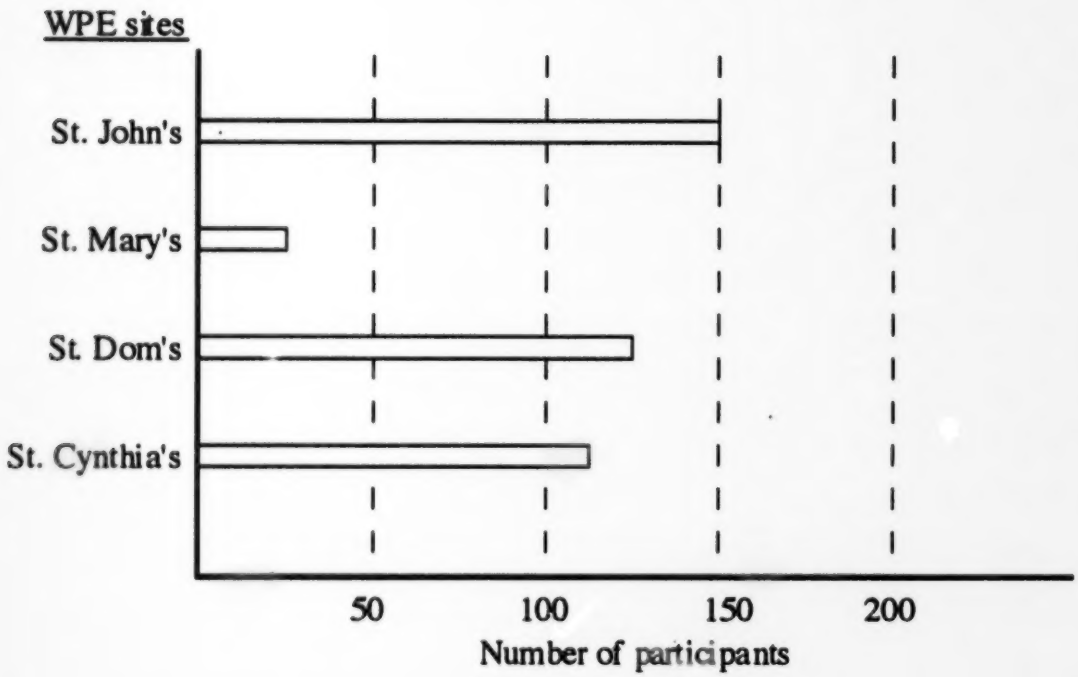
1. look at the **TITLE**
2. look at the **INFORMATION** written down the **VERTICAL** axis and across the **HORIZONTAL** axis of the graph
3. check to see if the graph has a **KEY**
4. use **APPROXIMATION** to get your figures

APPROXIMATION

It is sometimes difficult to get exact answers from a bar graph unless the bar stops exactly on one of the intervals. When the bar is between two of the intervals, use the following steps to reach an approximate figure:

1. locate the lines before and after the end of the bar
2. estimate your answer using a point between these two values
3. determine if your approximate answer is reasonable in terms of the bar's location between the two numbers.

Yearly Attendance at Selected WPE Sites



Answer the following questions.

1. What is the number of participants at St John's? _____

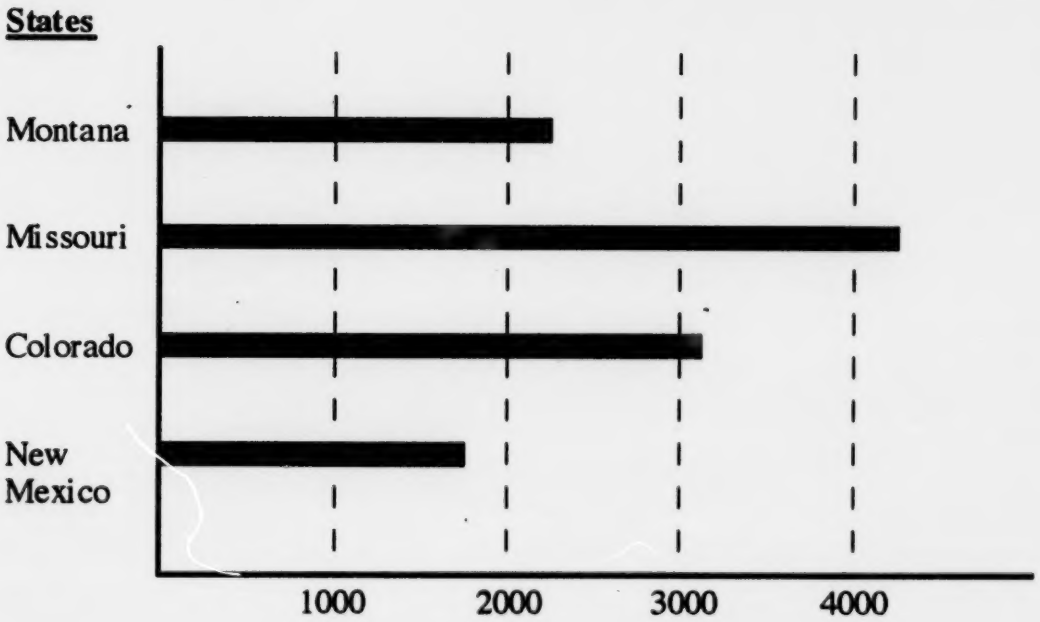
2. What is the approximate number of participants at St. Cynthia's?
_____

3. What is the difference between the number of participants at St. Dom's and St. Mary's? _____

4. How many participants were there in the program? _____

16

Nurses by States
(rate per 100,000 in population)



Answer the following questions using the bar graph.

1. How many more nurses are there in Missouri than in Montana? (Use approximation to get your answer) _____

2. Which state has the fewest number of nurses per 100,000 people? _____

3. Which state as the most nurses per 100,000 people? _____

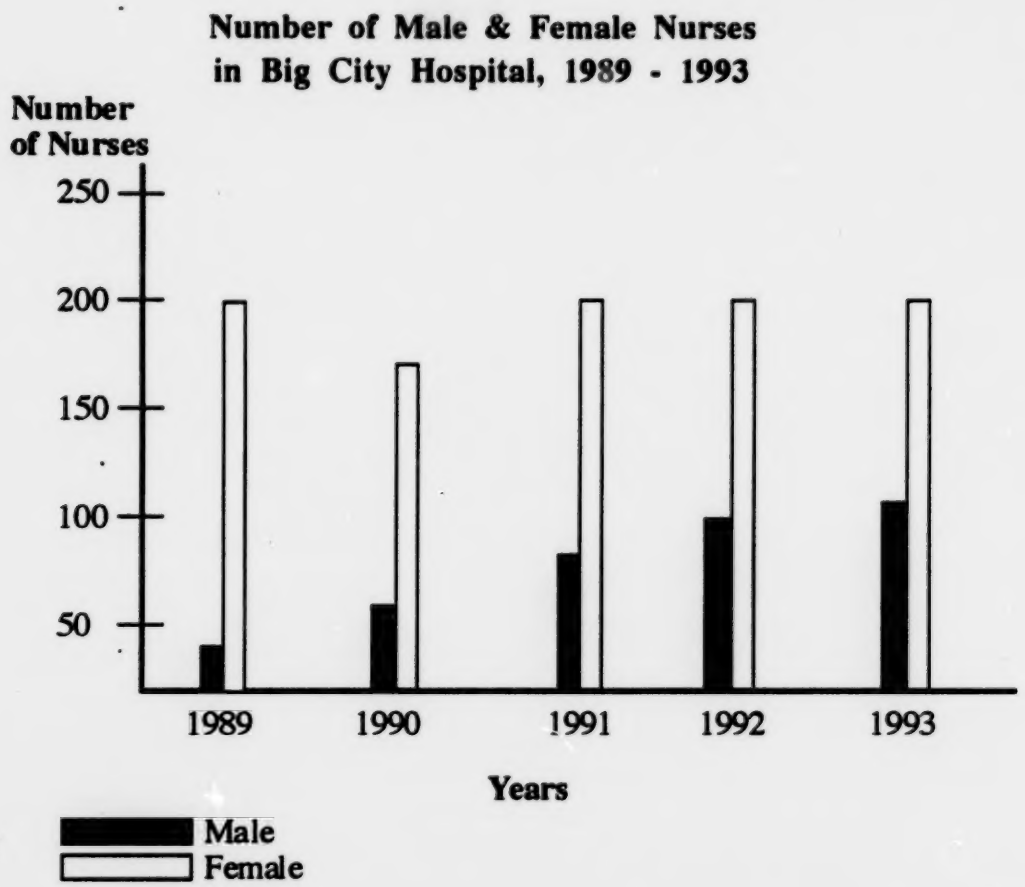
4. What information or data is on the horizontal axis? _____

5. What information or data is on the vertical axis? _____

6. What is this bar graph comparing? _____

_____

7. What is the approximate difference between the number of nurses in New Mexico and Colorado? _____



A COMPOUND BAR GRAPH compares two or more sets of data. Answer the following questions about this compound bar graph.

1. What information is on the vertical axis? _____

2. What information is on the horizontal axis? _____

3. According to the legend or key, is the male bar shaded or white? _____

4. How many male nurses were there in 1989? _____

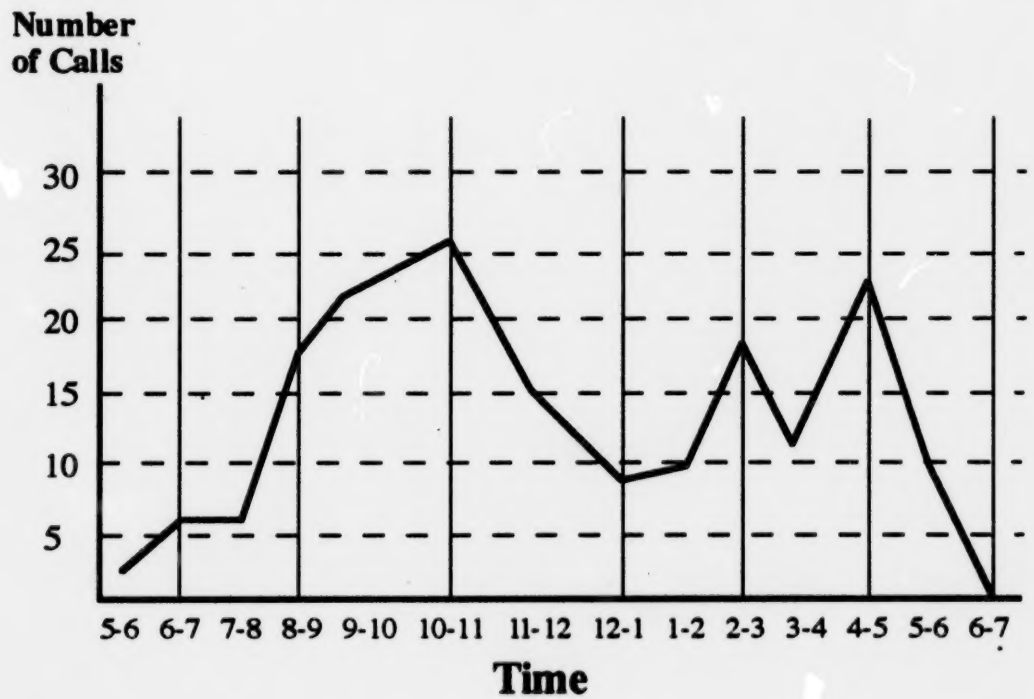
5. How many female nurses were there in 1991? _____

LINE GRAPHS

A line graph is used to show changing amounts. It is very effective in showing trends. As with a bar graph, when reading a line graph

1. read the **TITLE**
2. read the information down the **VERTICAL AXIS** and across the **HORIZONTAL AXIS**
3. read the **KEY**

EMERGENCY ROOM CALLS
For September 28, 1993



Answer the following questions concerning the line graph above.

1. What information is the graph showing? _____
   _____

2. The numbers on the vertical axis indicate what? _____
   _____

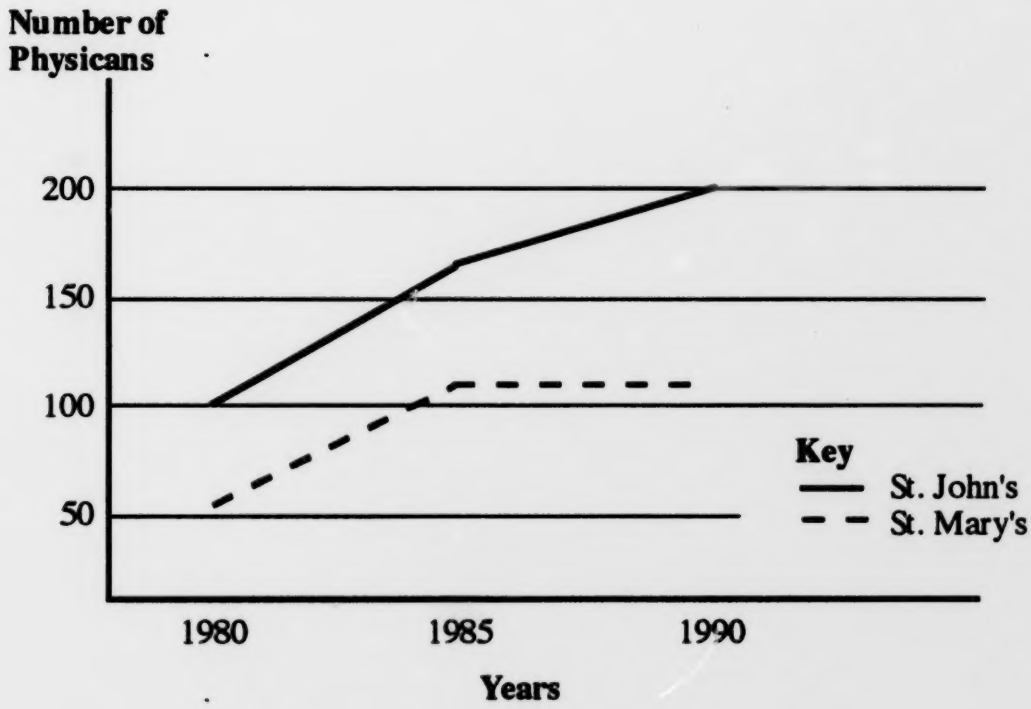
3. Which hour received the most calls? _____

4. Which hour received exactly 15 calls? _____

5. Approximately how many calls were there from 3-4? _____

Sometimes you will find a double line graph. Either the lines will be different colors or one will be solid and the other will be broken.

Physicians at Big City Hospital Systems



Answer the following questions about the double line graph.

1. Which hospital is represented by a broken line? _____

2. Which hospital is represented by a solid line? _____

3. Which hospital has the most physicians? _____

4. Which hospital increased its number of physicians between 1985 and 1990? _____

5. What is the title of this line graph? _____ _____

SECTION 3 - REASON FOR USING CHARTS AND GRAPHS

Interpreting charts allows individuals to draw conclusions and make comparisons. Often it is much easier to see the relationship between various things when they are presented visually in a chart or graph.

Read the following paragraph.

> The emergency room (E.R.) is keeping a record of all incoming calls. The first 30 minutes of the day, 3 calls came into the E.R. That was from 5:30-6:00 AM. From 6:00-7:00 AM, 6 calls were answered. During the remaining hours until noon, 86 calls came in: from 7:00-8:00 AM, 6 calls; from 8:00-9:00 AM, 18 calls; from 9:00-10:00 AM, 21 calls; from 10:00-11:00 AM, 26 calls; and from 11:00 AM -12:00 noon, 15 calls. During the first hour and a half and between 8:00-9:00 AM, all calls were answered within 10 seconds. Between 7:00-8:00, 83% of the calls were answered within 10 seconds. The rest were answered within 20 seconds. Between 9:00-10:00 AM, 81% were answered within 10 seconds, and 100% were answered within 20 seconds. Between 10:00 and 11:00 AM, 88% were answered in 10 seconds, and 96% were answered within a minute. Four percent of the calls rang over a minute or the party hung up. From 11:00 AM until 12:00, 87% of the calls were answered within 10 seconds; 93% were answered within 20 seconds; and the rest of the calls were answered within 30 seconds.

The information in the paragraph above just covers the morning. The E.R. continued to keep information on afternoon calls. As you can see, this information, when written in paragraph form, is very confusing. Also when

the material is presented in this way, it is very difficult to make comparisons between the number of calls made at different hours.

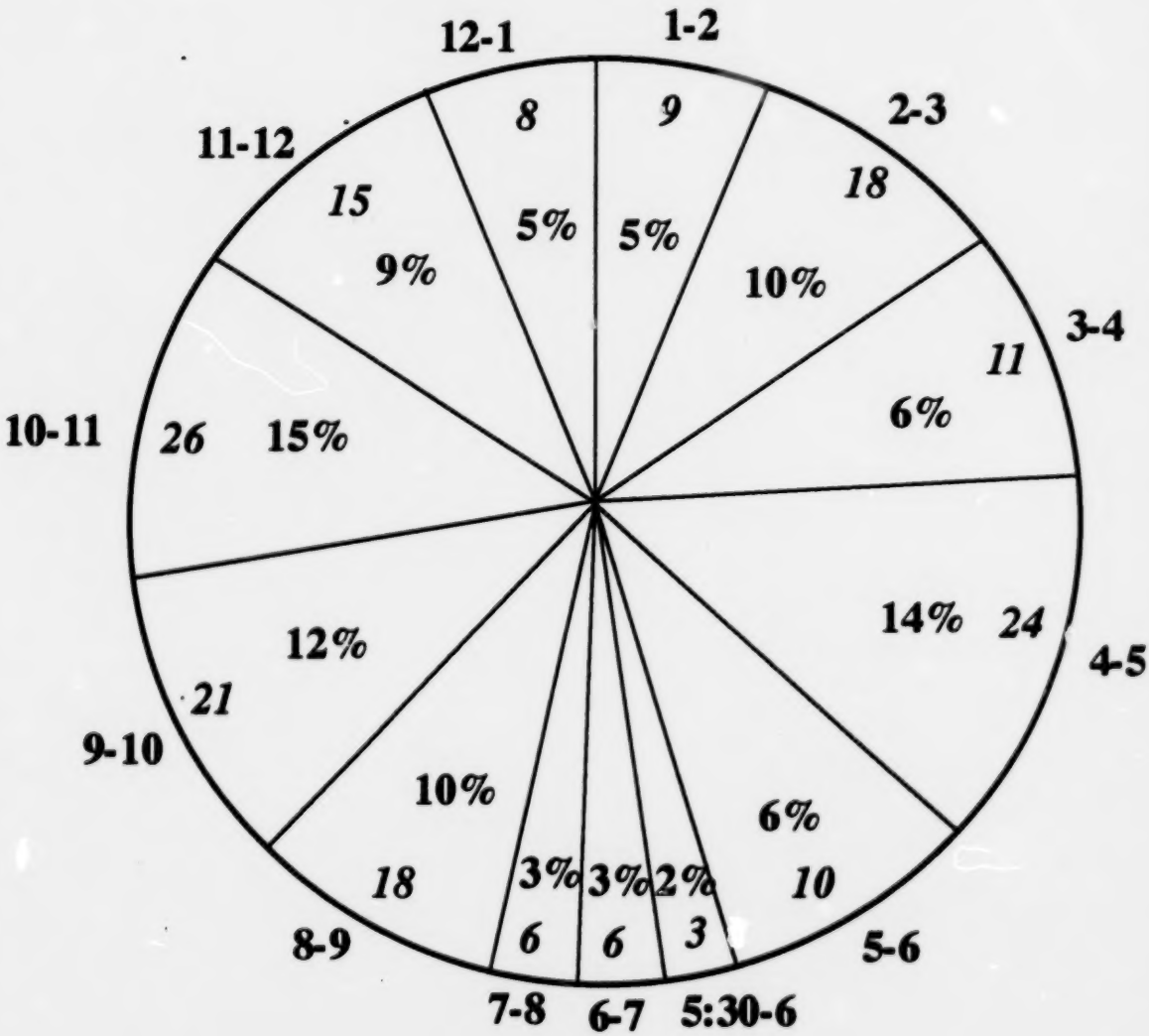
Now look at the same information in a chart. Is it easier to read?

ANSWERED CALL PROFILE
ACD Group Admissions
September 28, 1993

Time of day	No. of Calls	% of calls Answ'd within x seconds					
	Answ'd	10	20	30	40	50	60
05:30-06:00	3	100	100	100	100	100	100
06:00-07:00	6	100	100	100	100	100	100
07:00-08:00	6	83	100	100	100	100	100
08:00-09:00	18	100	100	100	100	100	100
09:00-10:00	21	81	100	100	100	100	100
10:00-11:00	26	88	96	96	96	96	96
11:00-12:00	15	87	93	100	100	100	100
12:00-13:00	8	100	100	100	100	100	100
13:00-14:00	9	100	100	100	100	100	100
14:00-15:00	18	94	100	100	100	100	100
15:00-16:00	11	100	100	100	100	100	100
16:00-17:00	24	79	100	100	100	100	100
17:00-18:00	10	100	100	100	100	100	100
18:00-18:00	0	0	0	0	0	0	0
Total	175	91	99	99	99	99	99

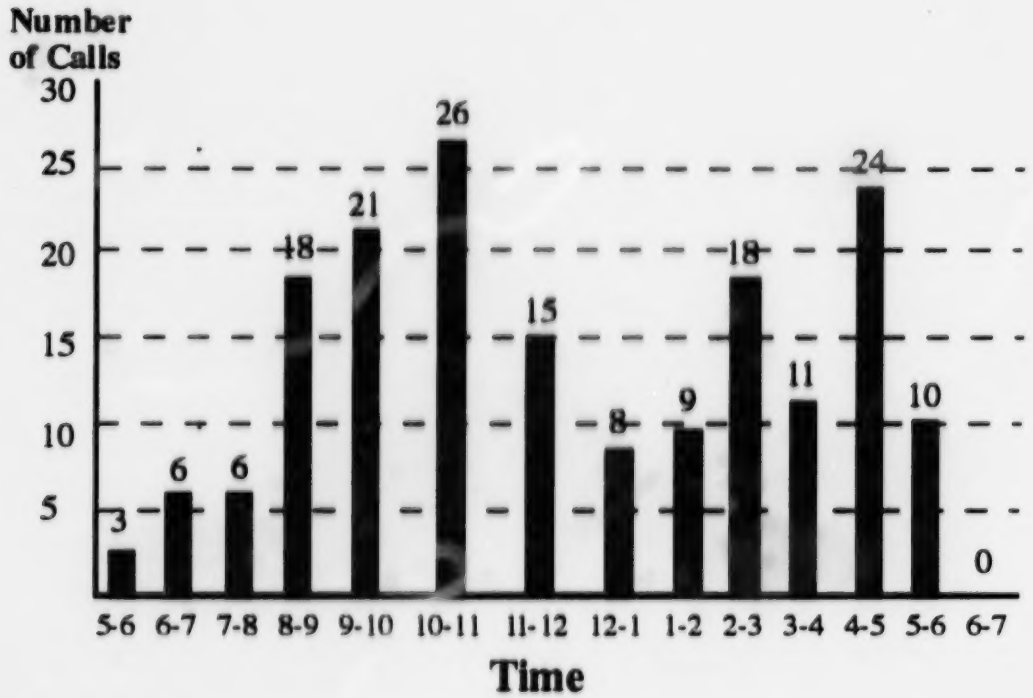
Consider if the information was placed in a pie chart or circle graph. What information does the pie chart show you? What information does this pie chart leave out?

TELEPHONE CALLS

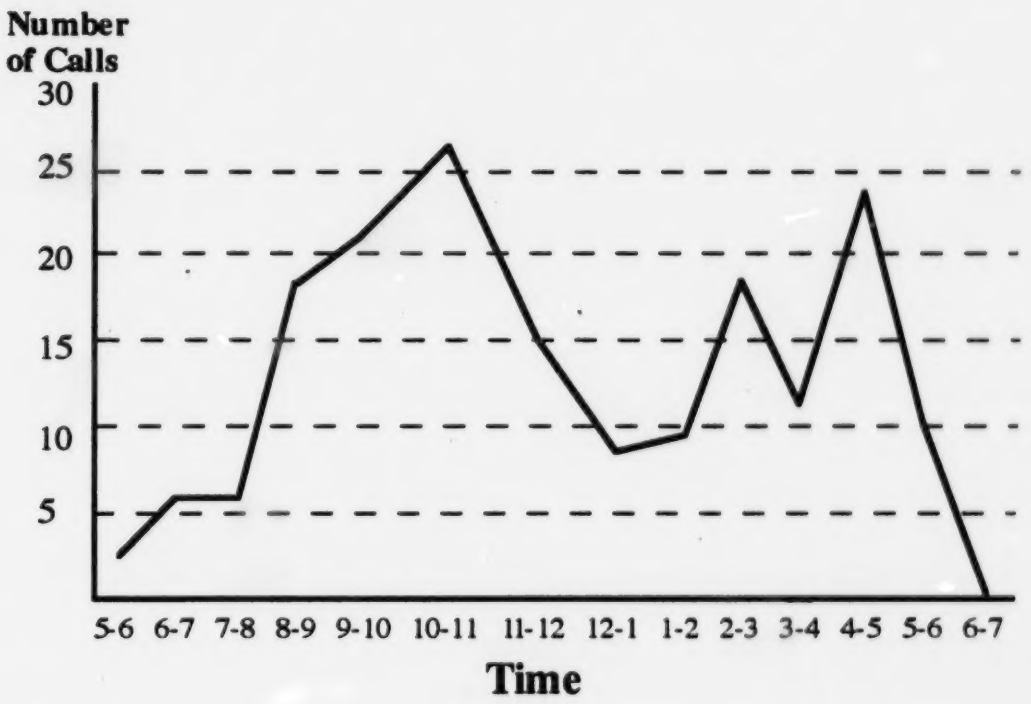


Outer numbers = hour of the day
Inside numbers (italicized) = # of calls received during each hour
Inner numbers = % of calls received

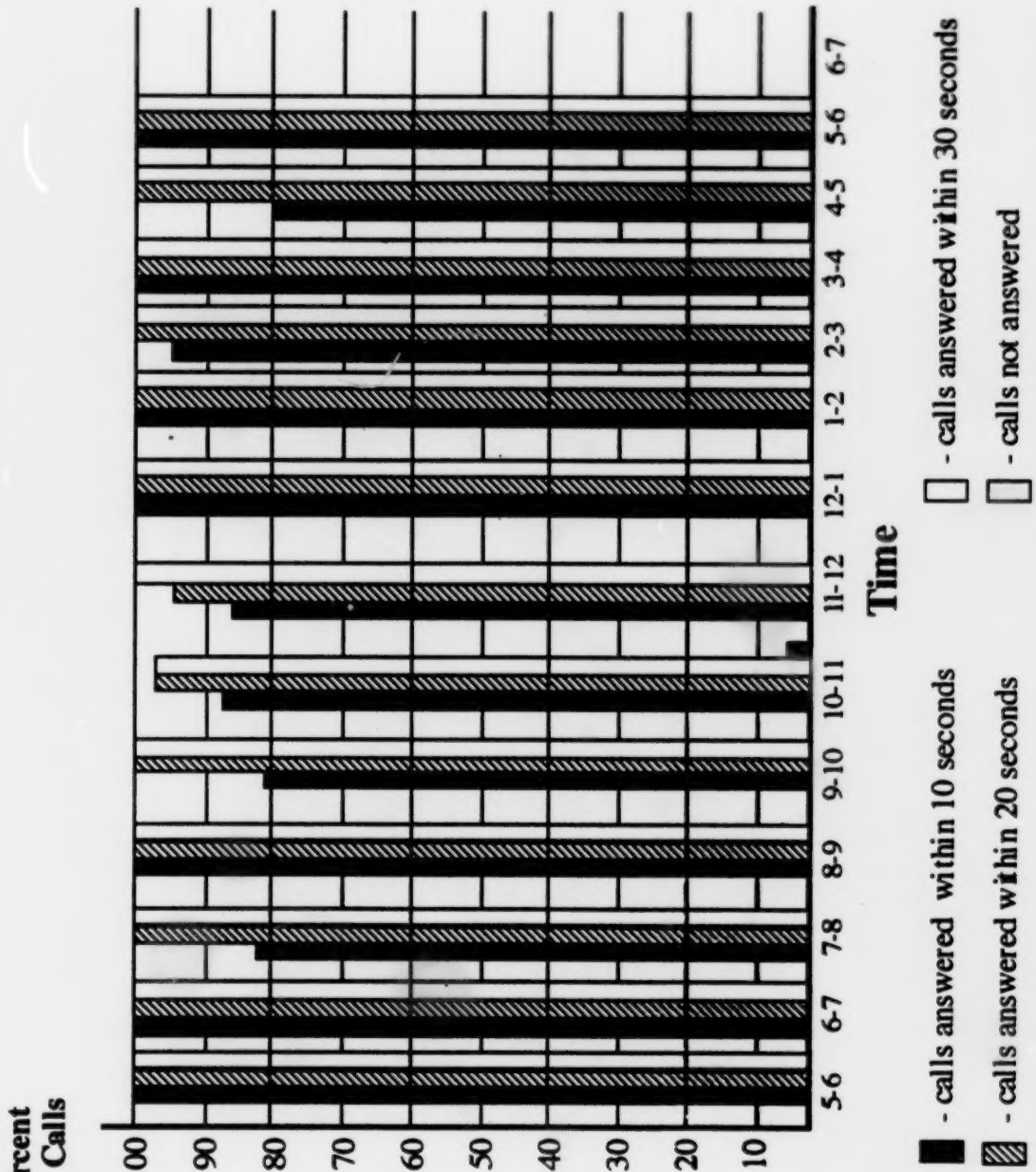
What if the same information were put in a bar graph? This graph allows you to see immediately the hours when the most calls came in. By looking at the tops of the bars, you can see the hours with heavy and light calls instantly.



The information can also be placed on a line graph. Like the bar graph it also shows very quickly peak call hours.



If you want to include the number of calls answered within a specific number of seconds, a compound bar graph can show this information.



Graphs and charts are very effective formats to present data in a way that is clear and quickly understood. You will find that learning to read graphs and charts can be helpful in both your work situation and your personal life.

SECTION 4 - VOCABULARY EXERCISE

horizontal
vertical
axis
axes
data
pictograph
bar graph
circle graph
legend or key

Fill in the blanks with the right word.

1. A _____ uses small pictures or symbols to represent information.
2. A pie graph is another name for a _____ .
3. A _____ axis goes up and down.
4. A _____ axis goes from side to side on the bottom.
5. _____ is the plural of axis.
6. A _____ uses information bars to represent data.
7. A _____ explains something about the graph.
8. _____ is a word that means the same as information.

ANSWER KEY

SECTION I - READING CHARTS

Page 2

1. Time Schedule for Employees
2. 6
3. May
4. B. Able
5. G. Smith
6. C. Daniels

Page 3

1. 200
2. 6
3. 2%
4. 350
5. 15%
6 27%
7. 57

SECTION 2 - READING GRAPHS

Pictographs - Page 6

1. Earnings in Nutritional Services
2. Nutritional Services
3. $2.00
4. Chefs
5. Tray passers
6. $1.00

Circle Graphs - Page 8

1. 40%
2. 20%
3. 100%
4. 50%

Bar Graphs - Page 10

1. 150
2. 110 (approximately)
3. 100 (approximately)
4. 410 (approximately)

Bar Graphs - Page 11-12

1. 2000 (approximately)
2. New Mexico
3. Missouri
4. Number of nurses
5. States
6. Number of nurses by states
7. 1400 (approximately)

Bar Graphs - Page 13

1. Number of nurses
2. years
3. shaded
4. 45 (approximately)
5. 200

Bar Graphs - Page 16

1. Number of emergency room calls
2. Number of calls
3. 10-11
4. 11-12
5. 12 (approximately)

Bar Graphs - Page 17-18

1. St. Mary's
2. St. John's
3. St. John's
4. St. John's
5. Physicians at Big City Hospital Systems

Vocabulary Exercise - Page 27

1. pictograph
2. circle graph
3. vertical
4. horizontal
5. axes
6. bar graph
7. legend or key
8. data

HELPFUL RESOURCES

Howett, Jerry. "Graphs and Tables." *GED Preparation for the High School Equivalency Examination: Mathematics, New GED Test 5.* Chicago: Contemporary Books, Inc., 1992, pp. 180-201.

Mitchell, Robert and Donald Prickel. *Number Power 5: Graphs, Tables, Schedules, and Maps.* Chicago: Contemporary Books, Inc., 1983.

Suter, Allan D. *Real Numbers Developing Thinking Skills in Math: Tables Graphs and Data Interpretation.* Chicago: Contemporary Books, Inc., 1991.